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supplied at reasonable price, it is recommended that the State boards of health send a copy or a reprint of this communication, with order blanks, to the physicians of States where malaria prevails.

A PORTABLE CYANIDE GAS GENERATOR FOR FUMIGATING SMALL COMPARTMENTS.

By C. M. FAUNTLEROY, Surgeon, United States Public Health Service.

The apparatus here described is designed to be used for the fumigation of small compartments on ships, such as living quarters, store-rooms, pantries, galleys, forepeak and poop spaces, forecastles, etc.,

A PORTABLE GENERATOR FOR FUMIGATING SMALL COMPARTMENTS WITH CYANIDE GAS.
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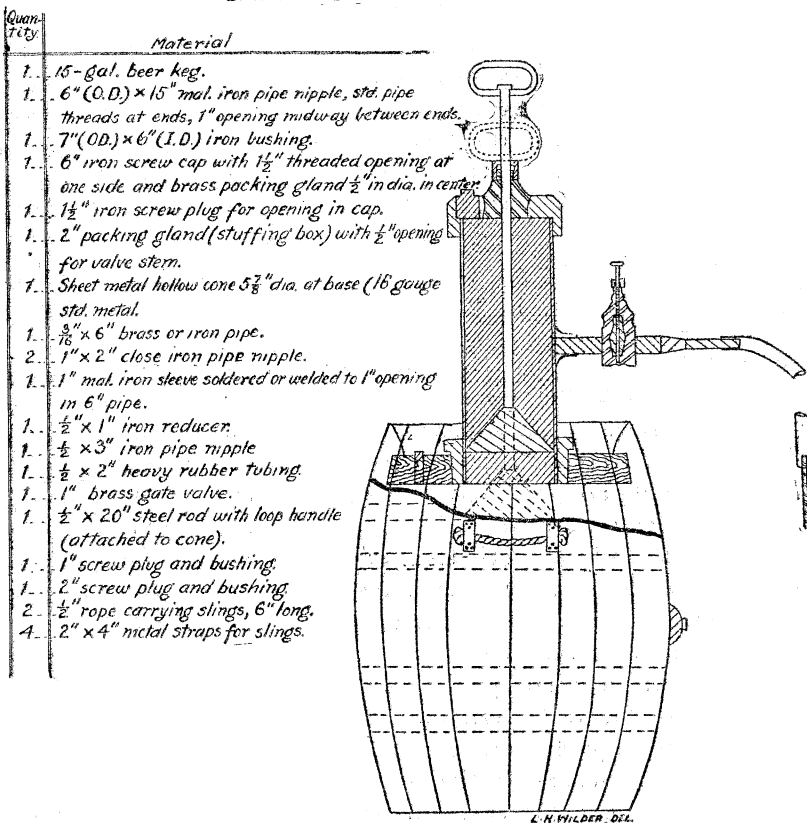
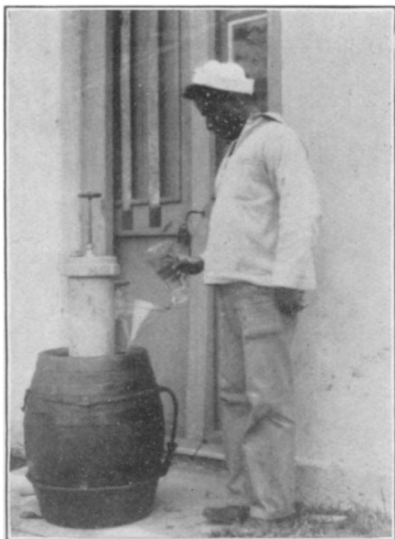


FIG. 1.

by a method of fractional generation of hydrocyanic acid gas. The gas is produced by the combination of dilute commercial sulphuric acid and dry sodium cyanide, in a portable generator, and is discharged into sealed compartments, from the outside, through the keyholes in doors or through other available small openings, such as windows and ventilators.



A. Introducing water and sulphuric acid into generator through $\frac{1}{2}$ -inch hole, preparatory to fumigation.



B. Introducing sodium cyanide through $1\frac{1}{2}$ -inch hole in cap, preparatory to fumigation. Valve is in proper position for loading.



C. Generator discharging gas through keyhole.

DESCRIPTION OF APPARATUS.

For purposes of description, the apparatus will be divided into two main parts, as follows: (1) Keg generator; (2) superstructure.

The keg generator.—The keg generator consists of an ordinary beer keg having a capacity of approximately 15 gallons. In the center of the top, there is inserted a standard cast-iron bushing having an inside diameter of 6 inches and an outside diameter of 7 inches. The bushing is tightly screwed to a circular opening sawed through the top, the threads being first covered with a thick mixture of red lead and linseed oil to insure tightness. Another iron bushing, with an inside diameter of 1 inch, is inserted in like manner through the top, midway between the large bushing and the side staves of the keg, and a 1-inch iron plug is screwed into this bushing. The circular opening in the center of one side of the keg is provided with standard pipe threads tapped into the heavy sheet iron which surrounds the opening, and a 2-inch iron bushing, with plug, is screwed into this opening. The small opening found in the bottom of the keg is tightly plugged and covered over with sheet lead held in place by 1-inch copper tacks. Two rope handles are attached to opposite sides of the keg, one-third the distance from the top to the bottom, and are held in place by metal straps securely fastened to the side of the keg by screws. The handles are made with manila rope, one-half inch in diameter, knotted at both ends to prevent slipping through the metal straps.

In making the selection of the kegs, care should be taken to use only those found to be in sound condition throughout.

The superstructure.—The superstructure consists of three main parts as follows: Cyanide hopper, long-stem valve, and discharge pipe. The cyanide hopper consists of a malleable iron pipe nipple, 6 inches in diameter and 15 inches in length, and provided with standard pipe threads at both ends on the outside surface. One end is covered with a standard cast-iron screw-cap having a threaded opening $1\frac{1}{2}$ inches in diameter, located to one side and closed by an iron plug. The metal cap is also fitted, exactly in the center of its top surface, with a brass packing gland having an opening $\frac{1}{2}$ inch in diameter for the operation of the valve stem. The other end of the hopper pipe is screwed into the large bushing inserted in the top of the keg generator, the threads being first covered with graphite grease to permit of easy removal of the pipe. The threads at the capped end of the hopper pipe are also covered with graphite grease, as are the threads on the iron plug which closes the opening in the metal cap.

In the center of one side of the hopper pipe, there is drilled a 1-inch hole, to which is welded an ordinary iron pipe sleeve threaded to receive a 1-inch pipe.

The long-stem valve consists of a smooth steel rod $\frac{1}{2}$ inch in diameter and 20 inches in length, with an oblong loop handle made of $\frac{1}{2}$ -inch round iron and held in position on the rod by a steel nut screwed onto the end of the steel rod. The lower side of the loop handle is flattened to permit the drilling of the $\frac{1}{2}$ -inch hole to receive the rod. To the other end of the steel rod there is welded a hollow cone made of malleable sheet iron of #16 gauge, U. S. standard measure, the base of which is exactly $5\frac{7}{8}$ inches in diameter. The rod is welded to the apex of the metal cone, which points upward. The steel rod passes through the opening in the packing gland, which is threaded through the exact center of the large metal cap covering the end of the hopper pipe, and forms a gas-tight joint. The packing gland is provided with a ring of graphite packing.

The discharge pipe consists of a 1-inch pipe nipple, 2 inches long, one end of which is screwed into the metal sleeve welded to one side of the cyanide hopper, the other end being screwed into a 1-inch brass gate valve. The other side of the valve receives one end of another 1-inch pipe nipple of the same length, the other end of which is screwed onto a metal reducer, 1-inch to $\frac{1}{2}$ -inch, to which is attached a $\frac{1}{2}$ -inch pipe nipple 3 inches long. To the end of this nipple is attached a noncollapsing rubber hose, 2 feet in length. To the other end of the rubber hose, there is attached a metal pipe 6 inches long and reduced to $\frac{3}{16}$ of an inch to permit its passage through key holes. An additional heavy rubber hose, $\frac{3}{4}$ inch in diameter and furnished with couplings and a reducer, may be substituted for the smaller pipe by connecting it with the pipe nipple next to the gate valve. The first three joints in the discharge pipe, including both 1-inch nipples and gate valve, are made as tight as possible, the threads being first treated with thick shellac varnish before the parts are assembled. All other joints beyond the gate valve are treated with graphite grease to facilitate removal.

PREPARATION FOR FUMIGATION AND DESCRIPTION OF OPERATION.

Each and every compartment which is to be subjected to cyanide fumigation must be very carefully prepared beforehand by the proper sealing of all cracks and other openings. This part of the procedure is of paramount importance and must be thoroughly done, otherwise a considerable percentage of the gas will be wasted by leakage and the efficiency of the fumigation will be much reduced. In order to facilitate the work and to promote efficiency, it is very desirable to inaugurate a standard routine method of procedure which will be strictly followed by the force of fumigators in every case, if possible.

The vessel to be fumigated is visited by the person who will have general supervision of the work. He examines all compartments that are to be fumigated, carefully estimates the space, and marks with chalk on the door or wall of each compartment the number of ounces of sodium cyanide which must be employed in the fumigation. The men who are assigned to the work of sealing the compartments proceed with the preparation, which includes, first, the proper disposition of the contents, so as to facilitate the access of the gas to every part of the interior space and contents thereof; and, second, the thorough sealing of all openings, large and small, except at the point where the gas will be admitted to the room, which is usually a keyhole, window, or ventilator.

The person supervising the fumigation determines accurately the quantity of sodium cyanide, sulphuric acid, and water which will be required to complete the fumigation of all the compartments, and instructs the men designated to operate the gas generator to place in the generator keg the entire quantity of the water and acid, in the order named, that will be necessary to complete the fumigation of all the compartments, this being done by means of a glass funnel placed in the opening provided for this purpose in the top of the keg generator. The entire personnel of the vessel having been previously accounted for, and the master's certificate obtained to the effect that the Government will not be responsible for any accidents resulting from the careless exposure of the personnel of his vessel to the gas during the fumigation, the process of fumigation is commenced.

The generator is placed just outside of the door of the compartment, or close to a window or ventilator, whichever is selected as the point of entrance of the gas. If the keyhole is employed for this purpose, the small pipe attached to the end of the rubber hose is inserted into the room: if the window or ventilator is selected, the large rubber hose is connected to the discharge pipe next to the gate valve, the other end of the hose is passed into the room, and the opening through which it enters the compartment is sealed by paper and paste or by pieces of canvas properly placed over the open space surrounding the hose. Having admitted the end of the discharge pipe to the room, one of the operators is instructed to open wide the gate valve and then proceed to "load" the superstructure with the required number of ounces of sodium cyanide (shown by the figure marked in chalk on the door or wall), which is accomplished in the following manner: The loop handle at the top of long-stem valve is pulled upward until the mark made on the steel rod appears at the top of the packing gland, indicating that the cone-shaped valve attached to the other end of the rod has reached a position in which

it completely closes the opening at the lower end of the hopper pipe. The iron plug is then unscrewed from the opening in the top of the metal cap, which closes the upper end of cyanide hopper pipe, and the required number of ounces of the sodium cyanide are dropped through this opening into the hopper pipe and upon the upper surface of the cone-shaped valve. The iron plug is replaced, and the operator is instructed to proceed. He grasps the handle on the top of the steel rod and pushes it straight downward by steady pressure until it rests upon the top of the packing gland. By the time it reaches this position, all the sodium cyanide will have been allowed to drop into the acid and water solution in the keg generator. The gas begins to be discharged into the compartment almost immediately, but the generator should be kept in place for not less than 2 minutes to complete discharging, if not more than 10 ounces of sodium cyanide were used. When the amount of cyanide exceeds 10 ounces, the time allowed for the generator to complete discharging gas should be about 5 minutes.

After the completion of the discharge of the gas into the compartment, the gate valve is closed and the discharge pipe is removed from the aperture, which must be sealed immediately in the manner previously indicated, and the generator is moved to the next compartment to be fumigated. The same procedure is repeated in the fumigation of each of the rooms, the fractional generation of the gas being accomplished as required for the various-sized compartments to be treated. The proportions in which the sodium cyanide, sulphuric acid, and water are mixed are, respectively, as follows: $1:1\frac{1}{2}:2$. Care must be taken that the proper proportions of the materials are used, because it is necessary for proper action that the liquid in the keg generator should contain a certain amount of excess acidity to insure the maximum generation of the gas when mixed with the sodium cyanide.

DESCRIPTION OF METHOD OF CLEANING APPARATUS.

Upon the completion of the fumigation of all the compartments in the manner described, it is important to properly clean the interior parts of the apparatus as soon as possible in order to prevent the destructive action of the acid solution upon the exposed parts and to prolong the life of the apparatus.

The iron plug is unscrewed from the opening in the side of the keg generator, which is then turned upon its side with the opening downward and all the acid liquid allowed to drain off through the opening. The generator is then placed in an upright position and carried to the nearest water-supply connection where there is installed an ordi-

nary $\frac{3}{4}$ -inch valve, one end of the large-sized rubber hose used as a discharge pipe in fumigating is connected, the other end is passed into the generator through the opening in the side, and the water is turned on and allowed to run until it overflows from this opening. The water is then turned off and the generator is turned upon its side and drained as above described, after which it is replaced in the upright position.

The end of the hose is now passed into the top of the hopper pipe through the opening in the metal cap used to admit the cyanide, and the water is again turned on and allowed to flow until it runs out through the opening in the side of the generator keg. The keg is finally drained of all water, as above described. If treated in this manner, all exposed parts of the apparatus will be adequately cleansed of all the acid solution and the apparatus made ready to be stored until further needed. Prior to the storing away of the apparatus, it is advisable to place graphite grease on the long steel rod and also upon the threads on all the iron plugs to facilitate their removal when the generator is again used.

BRIEF SUMMARY OF METHOD OF OPERATION AND OF CLEANING APPARATUS.

1. Remove small screw plug in top of keg generator and pass a glass funnel into the opening; then pour in, first, clean fresh water, followed by proper proportion of commercial sulphuric acid, 66-B, sufficient to complete entire fumigation. Replace the plug.

2. Place apparatus just outside of door, window, or ventilator of compartment. If placed near the door, insert small discharge pipe through keyhole. If placed near window or ventilator use the $\frac{3}{4}$ -inch rubber hose as discharge pipe, making connection just beyond the gate valve.

3. Open wide the gate valve on the discharge pipe.

4. Raise long-stem valve until mark on steel rod shows at top of packing gland.

5. Remove plug from large metal cap and drop into large pipe the number of ounces of sodium cyanide required to fumigate space. (This operation is repeated for each compartment.) Replace iron plug.

6. Push long-stem valve straight down until handle rests upon packing gland.

7. Allow from two to five minutes for discharge of gas into compartment.

8. Clean entire apparatus promptly as follows: Remove plug from side of generator keg and drain off acid solution. Attach $\frac{3}{4}$ -inch hose

to nearest suitable connection with general water supply and thoroughly flush inside of keg through opening in side; then pass end of hose into top of hopper pipe and run in water until it overflows from opening in side of keg. Finally turn generator on side and drain off all water. Before storing apparatus, lubricate steel rod and all iron plugs with graphite grease.

ADVANTAGES TO BE GAINED BY FUMIGATING WITH PORTABLE
GENERATOR.

1. It provides a safe, efficient, and rapid process for fumigating small compartments by hydrocyanic acid gas generated by fractional method.

2. It eliminates the necessity for the handling of large numbers of small containers commonly employed to generate the gas.

3. It requires less labor and material for cyanide fumigation of small compartments on vessels, and therefore reduces the expense.

4. It provides a much safer method of fumigating by cyanide gas than by the so-called "pot method," the necessity of having to endanger the lives of the men engaged in the fumigations being practically eliminated.

5. It provides a complete and compact equipment at a small expense, and can be easily transported and operated by two persons; and if properly cared for will remain in serviceable condition over a long period of time.

6. It provides no difficult structural features; the entire apparatus may be readily assembled in almost any locality by a person possessing but little knowledge of mechanics.

FAKE ARSPHENAMINE.

A Warning to Physicians and Druggists.

The following is taken from the Weekly Bulletin of the Department of Health of the City of New York, issue of June 4, 1921:

The Department of Health having made an investigation relative to the sale, in the city, of arspenamine of supposedly German origin, by seamen and other unscrupulous vendors, submitted several samples purchased to its chemical laboratory for analysis. The chemist's report shows the samples to be a fraudulent substitution, being a combination of sodium chloride and a yellow dye.

Physicians and druggists are accordingly warned against purchasing such products from unknown persons.

In this connection it is noted that on May 12, 1920, a circular letter was issued by the Surgeon General, warning against spurious products